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(54) IMPROVEMENTS IN OR RELATING TO SURGICAL NAILS FOR USE
IN THE TREATMENT OF BONE FRACTURES

(71) I, DOMENICO GALLUCCIO, an Italian Subject, of Via Maglie 133, Lecce, Italy, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention is generally concerned with treating bone fractures, particularly medial fractures in the collum femoris, olecranon, malleolus, forearm, and tibial plateau, and relates to a surgical nail which is designed to improve conventional techniques.

As is well known, when treating, for example, a medial fracture in the collum femoris, in accordance with conventional techniques, the patient is operated on after some days from trauma, that is after the patient has initially recovered and as allowed by his general condition. When the fracture is approximated, the bone parts are secured by one or two large steel surgical screws having a diameter of about 8 mm., or by a sturdy surgical nail of triangular cross-section.

Other techniques used are arthroprosthesis and endoprosthesis, which consists in replacing the hip joint or only the head by a metal prosthesis anchored in the bone by special cement.

Such binding and heavy operations are not well tolerated by elderly and sick patients, and the mortality range is around 20—25%.

When using screws, comparatively large areas of contact surface between the faces involved in the fracture are destroyed, such surface area amounting for example to about 0.50 sq.cm. in the case of an 8 mm. diameter screw. The same disadvantage occurs when using a triangular surgical nail which, in addition to being bulky, has a structure with rigid cutting edges.

As appreciated in relation to the present invention, the use of four small surgical nails having a diameter of 2 mm. (as usu-

ally required) destroys four-times less contact surface and, while conventional treatment provides no more than 50% success after one year and more, the results rise to 90% when employing surgical nails for surgical operations as proposed according to the invention.

Therefore, the object of the present invention is met by providing a surgical nail that can be readily introduced manually into soft body parts, such as with a hypodermic needle, until meeting the hard bony face and is then driven by means of a hammer. No scalpel is required as no incision is made, and the patient can be immediately treated on entry into hospital or otherwise without delay.

According to the present invention, there is provided a surgical nail for use in treating bone fractures, such as in the collum femoris, said nail comprising a smooth cylindrical stem having a pointed front end, and a smooth cylindrical rear end part having a diameter larger than that of said stem and joined to said stem by a frusto-conical portion.

The larger diameter rear end part is effective in preventing any movements of the nail, into the pelvis for example; moreover, the large diameter rear end part is of assistance in driving the nail by means of a hammer. Preferably, the overall length of the nail is from about 3 cm. to about 20 cm., and the diameter of said stem is from about 1 mm to about 4 mm.

An embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings in which:

Fig. 1 is a schematic view showing a femoris, the collum of which is fractured;

Fig. 2 shows the fractured collum femoris of Fig. 1 after treatment using screws according to a known technique;

Fig. 3 is a side view of a surgical nail according to the present invention;

Fig. 4 is an enlarged view showing the

front end or tip of the nail shown in Fig. 3; and,

Fig. 5 shows the fractured collum femoris of Fig. 1 after treatment using nails as shown in Figs. 3 and 4.

Referring to Fig. 1 of the drawings, there is schematically shown a femoris 10, the collum 11 of which is fractured at 12.

Fig. 2 shows the femoris of Fig. 2, after fracture treatment using two large screws 13 of conventional form firmly securing the two bone parts to each other according to known techniques. The use of screws as shown in Fig. 2 suffers from the above-mentioned disadvantages, and such screws will not be further described herein as they do not form part of the present invention. Generally, it can be said that, in addition to destroying large areas of the contacting bone parts, the use of screws does not allow a satisfactory distribution of stresses and strains between said screws and the collum femoris bone.

The surgical nail according to the invention, as shown in Fig. 3, can however be employed according to the new technique illustrated schematically in Fig. 5, to provide better strain distribution. This nail according to the invention comprises a smooth cylindrical stem or shank 14 having a length relatively long in relation to its diameter and having a pointed front end 15 and a rear end part or tail 16 of larger diameter than that of the stem 14. The tail 16 of the nail is joined to the stem 14 by a frusto-conical intermediate portion 17. As shown in Fig. 4, the front end 15 has a tip of triangular form which assists in manually driving the nail through soft body parts and also allows the nail to be more easily driven through bony parts by means of a hammer.

It has been found that the best dimensions of the surgical nails for treating fractures in the collum femoris, according to the present invention, are 9 to 11 cms. overall length, with a stem diameter of about 1.5 to 2.5 mm. and a tail diameter of 3 mm. or slightly more.

For malleolus fractures, the length should be about 5 to 7 cm. and the stem diameter about 1.5 to 2.0 cm.

For olecrane fractures, the length should be about 10 to 16 cm. and the stem diameter about 1.5 to 2.0 cm.

The above dimensions are not, of course, of a limiting nature and, according to the particular use of the surgical nail, lengths ranging from 3 to 20 cm. and stem diameters ranging from about 1 to 4 mm. can be employed.

As shown in Fig. 5, because of their comparatively small diameter, surgical nails ac-

cording to the present invention and designated generally by reference numerals 18 can be arranged at some distance from and all around the neutral axis of the collum femoris. Thus, by thoroughly adhering to the bone, such surgical nails are capable of fully bearing the tensile stresses involved, leaving to the fracture surface the task of bearing the major portion of the compressive stresses.

The provision of the enlarged tail 16 will prevent the surgical nail from inadvertently moving into the patient's pelvis, which would be extremely hazardous; moreover, the smoothly rounded and corner-free surfaces of the nail portion projecting from the bone do not cause damage to the patient.

From the foregoing and as illustrated by the accompanying drawings, it will be appreciated that the use of surgical nails according to the invention for treating bone fractures, such as in the collum femoris, provides the following advantages: the possibility of prompt action soon after trauma, on virtually any patient and not in selected cases as previously; ready suppression of pain; a more effective arrangement for the metal reinforcing structure; and ease of removal of plaster and related appliances.

WHAT I CLAIM IS:—

1. A surgical nail for use in treating bone fractures, such as in the collum femoris, said nail comprising a smooth cylindrical stem having a pointed front end, and a smooth cylindrical rear end part having a diameter larger than that of said stem and joined to said stem by a frusto-conical portion.

2. A surgical nail for use in treating bone fractures as claimed in Claim 1, in which said pointed front end of the nail has a tip of triangular form.

3. A surgical nail for use in treating bone fractures as claimed in Claim 1 or 2, in which the overall length of the nail is from 3 cm. to 20 cm.

4. A surgical nail for use in treating bone fractures as claimed in any of Claims 1 to 3, in which the diameter of said stem is from 1 mm. to 4 mm.

5. A surgical nail for use in treating bone fractures, substantially as hereinbefore described with reference to Figs. 3 to 5 of the accompanying drawings.

6. A surgical nail according to any one of the preceding claims, in which the cylindrical rear part is provided with a smoothly rounded end remote from said stem.

7. A method of treating a bone fracture, such as a fracture of a collum femoris, in which a plurality of surgical nails according to any one of the preceding claims are

so driven into the bone in paths generally parallel to a neutral axis of the bone that they are arranged in spaced relation to and around the said neutral axis.

- 5 8. A method according to Claim 7, in which each surgical nail is first introduced manually into a soft body part surrounding the bone before being driven into the bone.

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